

REMARKS/ARGUMENTS

This case has been carefully considered in light of the Office Action dated March 3, 2004, wherein claims 1 - 4, 7, 8, 11 - 14, 18, 22, 25 and 26 are rejected under 35 USC 102(b) as being anticipated by Dicky et al (US 5,832,880); claims 1, 2, 5, 8, 12 - 15, 18 and 22 are rejected under 35 USC 102(b) as being anticipated by DeLuca et al (US 5,870,996); claims 1, 2, 5 - 8, 11 - 15, 19 - 22, 25 and 26 are rejected under 35 USC 102(e) as being anticipated by Ancimer et al (US 2002/0166515 A1); claims 1, 2, 5, 6, 8, 9, 13 - 16, 19 - 23, 27 - 31 are rejected under 35 USC 102(b) as being anticipated by Hsu et al (US 5,365,902); and claims 9, 10, 16, 17, 23, 24 , 27 and 31 are rejected under 35 USC 103(a) as being unpatentable over DeLuca et al; claims 9, 10, 16, 17, 23, 24 , 27 - 35 are rejected under 35 USC 103(a) as being unpatentable over Ancimer. In this amendment, claims 1, 13, 27, 34 and 35 have been amended. Claim 3, 18 have been canceled. No new matter has been added.

Claims 1, 2, 4 -17, 19 – 35 remain pending in this application. Reconsideration in view of the above amendments and following remarks is respectfully requested.

Rejection under 35 U.S.C. §102

Claims 1 - 4, 7, 8, 11 - 14, 18, 22, 25 and 26 are rejected under 35 USC 102(b) as being anticipated by Dicky et al (US 5,832,880). Independent Claims 1 and 13 have been amended. Claim 3, 18 have been canceled. Applicants respectfully traverse the rejection of Claims 1, 2 and 4 - 17, 19 – 26 under 35 USC 102.

Independent claims 1 and 13 have been amended to incorporate the subject matter of claims 3 and 18 respectively. Amended version of independent claim 1 now recites that the controlling fuel injection step comprises:

“regulating a temperature of a pre-determined quantity of fuel supplied to said at least one fuel injector;

regulating a pressure of said pre-determined quantity of fuel supplied to said at least one injector”.

Amended version of independent claim 13 now recites that the compression ignition engine system comprises:

“a fuel injection system comprising at least one fuel injector, said system configured to inject a regulated quantity of temperature regulated, pressure regulated fuel using

said at least one fuel injector into said at least one cylinder when said piston is at least one of reciprocating from said TDC toward BDC during an intake stroke and at BDC reciprocating toward TDC during a compression stroke."

Dicky et al do not teach, suggest or disclose each and every element of Applicants' invention as recited in amended independent Claims 1 and 13. As mentioned above, the amended independent Claims 1 and 13 of the Applicants' invention recite regulating temperature and pressure of a predetermined quantity of fuel. On the other hand, Dicky et al merely disclose a method for repeatable and accurate control of the start of combustion in a HCCI diesel engine. In that connection, Dicky teaches measurement of temperature and pressure of the burning mixture of gas and fuel in the combustion cylinder and the means to incorporate that in the combustion strategy. However, Dicky et al do not disclose a pressure and temperature regulating step for the fuel before the fuel is introduced in the combustion cylinder. As such, Dicky et al do not disclose every element of the independent claims 1 and 13 of the Applicants' invention. Therefore, in the present invention, the amended independent claims 1 and 13 are not anticipated by Dicky et al.

Claims 2, 4-8 and 11 – 12 depend directly or indirectly from claim 1 and are therefore similarly not anticipated by Dicky et al. Applicants respectfully submit that these claims are allowable by dependency. Claims 14, 22, 25 and 26 depend directly or indirectly from claim 13 and are therefore similarly not anticipated by Dicky et al and these claims are allowable by dependency. Withdrawal of the rejection under 35 USC 102(b) of claims 1, 2, 4, 7, 8, 11 - 14, 22, 25 and 26 over Dicky et al is respectfully solicited.

Claims 1, 2, 5, 8, 12 - 15, 18 and 22 are rejected under 35 USC 102(b) as being anticipated by DeLuca et al (US 5,870,996). Independent claims 1 and 13 have been amended. Claim 3, 18 have been canceled. Applicants respectfully traverse the rejection of Claims 1, 2, 5, 8, 12 – 15 and 22 under 35 USC 102.

DeLuca et al do not teach, suggest or disclose each and every element of Applicants' invention as recited in amended independent Claims 1 and 13. Amended versions of independent claims 1 and 13 of the Applicants' invention recite regulating temperature and pressure of a predetermined quantity of fuel. In stark contrast, DeLuca et al do not disclose a pressure and temperature regulating method or system for the fuel. DeLuca et al merely disclose a system comprising diesel fuel injectors and fuel injection pumps of the mechanical spill type. DeLuca et al are silent on the question of regulating fuel temperature and pressure, and thus there is no teaching or suggestion in this reference that fuel pressure and temperature can or should be regulated before actual combustion begins in the combustion cylinder. As such, DeLuca et al do not disclose every element of the independent claims 1 and 13 of the Applicants'

invention. Therefore, in the present invention, the amended independent claims 1 and 13 are not anticipated by DeLuca et al.

Claims 2, 5, 8 and 12 depend directly or indirectly from claim 1 and are therefore similarly not anticipated by DeLuca et al and these claims are allowable by dependency. Claims 14, 15 and 22 depend directly or indirectly from claim 13 and are therefore similarly not anticipated by DeLuca et al and these claims are allowable by dependency. Withdrawal of the rejection under 35 USC 102(b) of claims 1, 2, 5, 8, 12 – 15 and 22 over DeLuca et al is respectfully solicited.

Claims 1, 2, 5 - 8, 11 - 15, 19 - 22, 25 and 26 are rejected under 35 USC 102(e) as being anticipated by Ancimer et al (US 2002/0166515 A1). Independent claims 1 and 13 have been amended. Claim 3, 18 have been canceled. Applicants respectfully traverse the rejection of Claims 1, 2, 5 - 8, 11 - 15, 19 - 22, 25 and 26 under 35 USC 102.

Ancimer et al do not teach, suggest or disclose each and every element of Applicants' invention as recited in amended independent Claims 1 and 13. Amended versions of independent claims 1 and 13 of the Applicants' invention recite regulating temperature of a predetermined quantity of fuel, and regulating pressure of a predetermined quantity of fuel. In contrast, Ancimer et al do not disclose a pressure and temperature regulating method or system for the fuel. Ancimer et al merely disclose a combustion strategy for varying loads and speeds and all that they mention with respect to controlling temperature before combustion is that in one embodiment, an electronic control unit (ECU) "can also recalibrate the premixed combustion stability limit to compensate for changes in intake manifold pressure and temperature. Alternatively, the intake manifold temperature and pressure can be monitored and adjusted to maintain substantially constant values for predetermined operating conditions" (page 10, para 113). As is evident to those skilled in the art, monitoring and adjusting the intake manifold temperature and pressure is different from regulating the temperature and pressure of the fuel even before it is introduced into the intake manifold and is still in the fuel supply system as is mentioned in the Applicants' invention (page 5, para 16):

"Fuel injector 130 is in communication with a fuel supply system 132 that includes a subsystem configured to regulate a temperature of the fuel to facilitate achieving an optimal vaporization."

In summary, Ancimer et al teach that the intake manifold temperature and pressure can be monitored and adjusted to maintain substantially constant values for predetermined operating conditions. On the other hand, the Applicants' invention discloses regulating the temperature and pressure of the fuel in order to achieve an optimal vaporization.

Thus, Ancimer et al do not disclose every element of the independent claims 1 and 13 of the Applicants' invention. Therefore, in the present invention, the amended independent claims 1 and 13 are not anticipated by Ancimer et al.

Claims 2, 5 - 8, 11 and 12 depend directly or indirectly from claim 1 and are therefore similarly not anticipated by Ancimer et al and these claims are allowable by dependency. Claims 14, 15, 19 - 22, 25 and 26 depend directly or indirectly from claim 13 and are therefore similarly not anticipated by Ancimer et al and these claims are allowable by dependency. Withdrawal of the rejection under 35 USC 102(b) of claims 1, 2, 5 - 8, 11 - 15, 19 - 22, 25 and 26 over Ancimer et al is respectfully solicited.

Claims 1, 2, 5, 6, 8, 9, 13 - 16, 19 - 23, 27 – 31 and 34 are rejected under 35 USC 102(b) as being anticipated by Hsu et al (US 5,365,902). Independent claims 1, 13, 27 and 34 have been amended. Claims 3, 18 have been canceled. Applicants respectfully traverse the rejection of Claims 1, 2, 5, 6, 8, 9, 13 - 16, 19 - 23, 27 – 31 and 34 under 35 USC 102.

Amended version of independent claim 27 now recites a railroad locomotive a fuel injection system comprising:

"at least one fuel injector, said system configured to inject a regulated quantity of temperature regulated, pressure regulated fuel using said at least one fuel injector into said cylinders at a crank angle of between about negative three hundred sixty degrees and about three hundred sixty degrees..

Amended version of independent claim 34 now recites a railroad locomotive comprising:

"a fuel injection system that comprises at least one fuel injector mounted in said at least one cylinder head, said fuel injector comprises a nozzle that is at least partially within said cylinder, said system configured to inject a regulated quantity of temperature regulated, pressure regulated fuel using said at least one fuel injector at a first pre-determined piston position that corresponds to a crank angle of between about negative three hundred sixty degrees and about zero degrees. and inject a second quantity of fuel into said cylinder at a second pre-determined piston position that corresponds to a crank angle of between about negative forty five degrees and about twenty degrees, such that a fuel/air equivalence ratio of the fuel/air mixture in each said cylinder at ignition is between 0.10 and .85."

Hsu et al do not teach, suggest or disclose each and every element of Applicants' invention as recited in amended independent Claims 1, 13, 27 and 34. Amended versions of independent claims 1, 13, 27 and 34 of the Applicants' invention recite regulating temperature

and pressure of a predetermined quantity of fuel. In stark contrast, Hsu et al do not disclose a pressure and temperature regulating method or system for the fuel. Hsu et al merely disclose a method for timing of pilot fuel and main fuel injections to combine diffusion combustion and premixed combustion in a dual fuel system. Hsu et al are silent on the question of regulating fuel temperature and pressure, and thus there is no teaching or suggestion in this reference that fuel pressure and temperature can or should be regulated before actual combustion begins in the combustion cylinder. As such, Hsu et al do not disclose every element of Applicants' invention as recited in claims 1, 13, 27 and 34. Therefore, in the present invention, the amended independent claims 1, 13, 27 and 34 are not anticipated by Hsu et al.

Claims 5, 6, 8, 9 depend directly or indirectly from claim 1 and are therefore similarly not anticipated by Hsu et al. Claims 14 - 16, 19 – 23 depend directly or indirectly from claim 13 and are therefore similarly not anticipated by Hsu et al. Claims 28 – 31 depend directly or indirectly from claim 27 and are therefore similarly not anticipated by Hsu et al. Withdrawal of the rejection under 35 USC 102(b) of claims 1, 2, 5, 6, 8, 9, 13 - 16, 19 - 23, 27 – 31 and 34 over Hsu et al is respectfully solicited.

Rejection under 35 U.S.C. §103

Claims 9, 10, 16, 17, 23, 24, 27 and 31 are rejected under 35 USC 103(a) as being unpatentable over DeLuca et al. Claims 9, 10, 16, 17, 23, 24 , 27 - 35 are rejected under 35 USC 103(a) as being unpatentable over Ancimer. In this amendment, independent claims 1, 13, 27, 34, 35 have been amended. Claim 3, 18 have been canceled.

Applicants interpret the Office Action as stating that DeLuca et al teach all elements of the Applicants' invention except "a specific number of cylinders" and number of cylinders is considered to be an obvious matter of design choice. However, the Applicants respectfully submit that in addition to this element, DeLuca et al do not teach anywhere two other elements of the Applicants' amended independent Claims 13 and 27 viz., regulating temperature of a predetermined quantity of fuel and regulating pressure of a predetermined quantity of fuel. DeLuca et al merely disclose a system comprising diesel fuel injectors and fuel injection pumps of the mechanical spill type. DeLuca et al are silent on the question of regulating fuel temperature and pressure, and thus there is no teaching or suggestion in this reference that fuel pressure and temperature can or should be regulated before actual combustion begins in the combustion cylinder. As such, DeLuca et al do not disclose every element of Applicants' invention as recited in independent claims 13 and 27. The Applicants respectfully submit that the two elements of regulating the temperature and pressure of the fuel are not obvious matter of design choice. Therefore, in the present invention, the amended independent claims 13 and 27 is not obvious over DeLuca et al.

Amended versions of the independent claims 1, 13, 27 and 34 of the Applicants' invention have been quoted earlier in connection with the Applicants' response to the 102 rejections. In addition, amended version of independent claim 35 now recites a railroad locomotive comprising:

"a fuel injection system comprising at least one fuel injector mounted in said combustion air inlet plenum, said fuel injector comprising a nozzle, said nozzle at least partially within said combustion air inlet plenum, said system configured to inject a regulated quantity of temperature regulated, pressure regulated fuel using said at least one fuel injector into said cylinders at a crank angle of between about negative three hundred sixty degrees and about three hundred sixty degrees, such that a fuel/air equivalence ratio of a fuel/air mixture in said cylinder at ignition is between 0.10 and .85."

Applicants interpret the Office Action as stating that Ancimer et al teach all elements of the Applicants' invention except "a specific number of cylinders" and "the equivalence ratio" and these two elements are considered to be matter of obvious design choice. However, the Applicants respectfully submit that in addition to these two elements, Ancimer et al do not teach anywhere two other non-obvious elements of Applicants' independent Claims 13, 27, 34 and 35 viz., regulating temperature of a predetermined quantity of fuel and regulating pressure of a predetermined quantity of fuel. Ancimer et al merely disclose a combustion strategy for varying loads and speeds and they are silent about the question of regulating the temperature and pressure of the fuel. As such, Ancimer et al do not teach, suggest, or disclose every element of Applicants' invention as recited in independent claims 13, 27, 34 and 35, and Applicants respectfully submit that the two elements of regulating the temperature and pressure of the fuel are not merely a matter of obvious design choice. Therefore, in the present invention, the amended independent claims 13, 27, 34 and 35 is not obvious over Ancimer et al.

Claims 3 and 18 have been canceled. Each of the remaining rejected dependent claims 9, 10, 16, 17, 23, 24, 25, 26, 28, 29, 30, 31, 32, 33 depend from an independent claim which Applicants believe to be in condition for allowance over Ancimer and DeLuca for the reasons discussed above with reference to the rejection under 35 USC 102 and 103. More specifically, claims 9, 10 depend directly from claim 1, claims 16, 17, 23, 24, 25, 26 depend directly from claim 13, claims 28, 29, 30, 31, 32, 33 depend directly from claim 27. Applicants respectfully submit that claims 1, 13, 27, 34 and 35 are patentably distinct from the applied references for the reasons discussed above and that claims 9, 10, 16, 17, 23, 24, 25, 26, 28, 29, 30, 31, 32, 33 are similarly allowable over the applied references based on their dependency. It is respectfully requested that the rejections be withdrawn.

Summary

In view of the foregoing, Applicants respectfully submit that the application is in condition for allowance. Favorable reconsideration and prompt allowance of the application are respectfully requested.

Should the Examiner believe that anything further is needed to place the application in condition for allowance, the Examiner is requested to contact Applicants' undersigned representative at the telephone number below.

Respectfully submitted,



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